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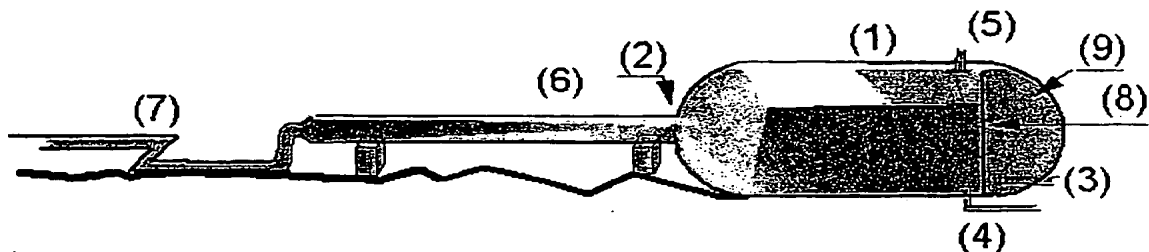
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DEVICE FOR SEPARATING MULTI-PHASE FLUIDS



(57) Abstract: A device in connection with a separator for separation of multiphase fluid, comprising a preferably cylindrical container (1) with an inlet (2), a first outlet (3) for liquid with a higher gravity (for example water); a second outlet (4) for liquid with a lower gravity (for example oil) and a third outlet (5) for gas. A pipe separator (6) is connected to the inlet (2) of the container (1). The pipe separator (6) constitutes a continuation of the supply pipe (7) for the fluid to be separated and extends partially into the container (1).

ATTACHMENT "E"

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Device for separating multi-phase fluids.

- 5 The present invention concerns a device in connection with a separator for separation of multiphase fluid, comprising a preferably cylindrical container with an inlet, a first outlet for liquid with a higher gravity (for example water), a second outlet for liquid with a lower gravity (for example oil) and a third outlet for gas.
- 10 The prior art contains gravitation separators of the above type for separation of fluids such as oil, water and gas which are used in a number of contexts in process plants on platforms and production ships or on the sea bed. However, depending on their capacity, such separators are large and heavy and require a lot of space.
- 15 The prior art also contains a new type of separator, called a pipe separator, that has been developed by the applicant of the present application and is based on separation in a pipe by means of laminar flow of the separable fluid in the pipe. This type of separator is very effective, requires little space and can be used at great depths of the sea. EP 0977621 shows and describes such a type of separator.
- 20 The present invention represents a separator solution based on a combination of the above two separator principles in which additional, more effective separation of the fluid to be separated is achieved.
- The present invention is characterised in that a pipe separator is connected to the inlet  
25 of the container. The pipe separator constitutes a continuation of the supply pipe for the fluid to be separated and is connected to or extends partially into the container, as stated in the attached Claim 1.
- By first partially separating the incoming fluid flow in the pipe separator before the further separation in the container, the separation process is optimised, thus achieving  
30 better performance and a reduced necessary separator volume.

Claims 2-3 define the advantageous features of the present invention.

5 The present invention will be described in further detail in the following by means of examples and with reference to the attached figure, which shows an elementary diagram of the present invention.

As the figure shows, the present invention comprises a conventional gravitation separator 1, comprising a preferably cylindrical container with an inlet 2, a first outlet 3  
10 for liquid with a higher gravity (for example water), a second outlet 4 for liquid with a lower gravity (for example oil) and a third outlet 5 for gas.

At the end of the container 1, a partition 8 is arranged expediently. It extends towards the upper end of the container and forms a threshold for liquid with a lower gravity (oil) to flow over to a chamber 9 on the right side of the container 1, where the second outlet  
15 4 is arranged.

The special feature of the solution in accordance with the present invention is that a pipe separator 6 is connected to the inlet 2 for the conventional gravitation separator 1. The pipe separator 6 constitutes a continuation of a supply pipe 7 for the fluid to be  
20 separated and extends partially into the gravitation separator 1. The pipe separator 6 has a diameter that is greater than the diameter of the supply pipe 7 and is large enough for stratified flow to be achieved. The pipe separator is mainly arranged horizontally, which is also a condition for stratified flow. The requirement for horizontality depends on the flow speed, i.e. the faster the flow, the greater the requirement for  
25 horizontality. Moreover, the requirement for horizontality for the pipe separator will depend on whether the flow is two-phase or three-phase. Three-phase flow will have a greater requirement for horizontality for the pipe separator 6.

The solution shown in the figure is a separator for oil, water and possibly gas, i.e. a  
30 three-phase separator, with water-continuous inflow. With water-continuous inflow, it is

advantageous for the inlet 2 to be arranged so that the outlet from the pipe separator 6 extends into the conventional radiator 1 at a level that requires the fluid to arrive in the separator in the water layer (water phase) in the separator. Conversely, it is expedient for the inlet to be arranged so that the inflow enters the oil phase in the separator 1 with oil-continuous inflow.

The two liquid phases (oil/water) that flow into the pipe separator 6 will gradually be separated as they flow through the pipe separator 6 so that oil/water layers will gradually be formed with average drop sizes that, at the inlet to the conventional separator 1, are considerably larger than if no pipe separator had been used. This results in the further separation in the conventional pipe separator being considerably faster and the conventional separator can be made much smaller.

The gas will be separated out much faster than the oil/water separation as the gravity of the gas is much lower than that of the two liquids. This means that the gas/gas bubbles, when they reach the container 1, will rapidly rise to the surface of the liquid and thus constitute a gas phase on the top of the surface of the liquid in the container and will be transported away from there via the gas outlet 5.

If a high gas/liquid ratio is expected, a pulse damping inlet arrangement should preferably be arranged in the conventional separator, for example an open screw housing inlet as described in the applicant's own EP patent application no. 1069957. In such case, the inlet 2 should also be positioned at a level higher than the liquid phase in the separator.

The transition between the pipe separator 6 and the conventional separator 1 should be designed so as to generate minimum shear forces in the flow. This is achieved by using smooth pipes with minimum bending radius (preferably none at all).

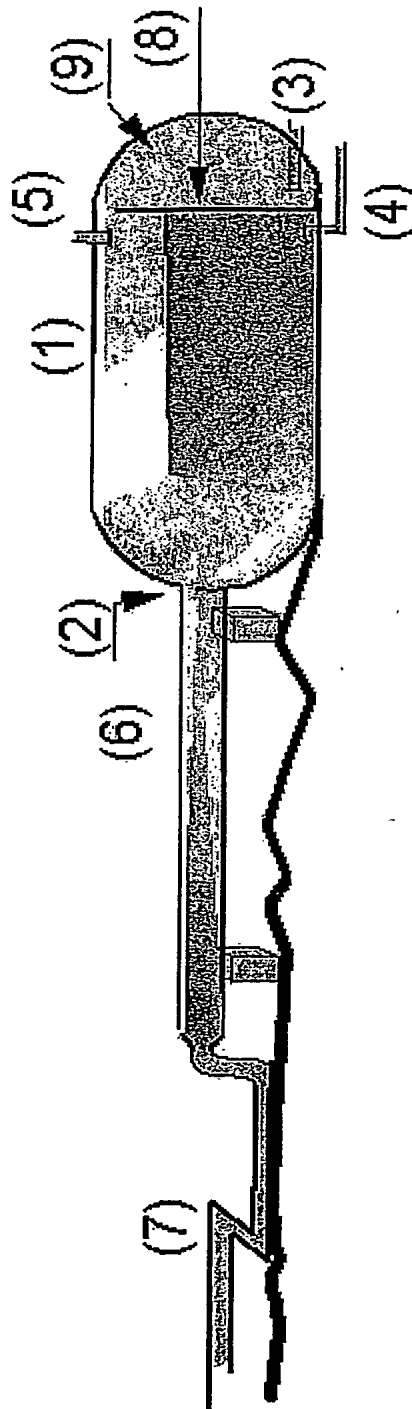
The inlet of the pipe separator may expediently be fitted with a device (not shown) to damp the input pulse of the inflowing multiphase flow.

The present invention as it is defined in the claims of the present application is not limited to the example shown in the attached figure and described above. The present invention may, therefore, be used to separate fluids other than oil, gas and water.

### Claims

1. A device in connection with a separator for separation of multiphase fluid, comprising a preferably cylindrical container (1) with an inlet (2), a first outlet (3) for liquid with a higher gravity (for example water), a second outlet (4) for liquid with a lower gravity (for example oil) and a third outlet (5) for gas,  
characterised in that  
a pipe separator (6) is connected to the inlet (2) of the container (1), whereby the pipe separator (6) constitutes a continuation of the supply pipe (7) for the fluid to be separated and is connected to or extends partially into the container (1).
2. A device in accordance with claim 1, where the fluid consists of oil, water and gas,  
characterised in that  
the inlet (2) is arranged, for water-continuous inflow, at a level in the container (1) equivalent to the level of the expected water phase in the container (1).
3. A device in accordance with claims 1 and 2,  
characterised in that  
the inlet (2) is arranged, for oil-continuous inflow, at a level in the container (1) equivalent to the level of the expected oil phase in the container (1).

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 03/00301

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01D 17/025

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01D, E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9841304 A1 (NORSK HYDRO ASA), 24 Sept 1998 (24.09.98) --	1-3
A	EP 1044711 A1 (SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.), 18 October 2000 (18.10.00) --	1-3
A	US 5695655 A (ABDELLATIF SMATI), 9 December 1997 (09.12.97) -- -----	1-3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

06/09/03

International application No.  
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